TRENT CANAL

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Peterborough

LIFT LOCK

The hydraulic lift lock on the Trent Canal system at Peterborough, Ont., is operated by the federal Department of Transport and, apart from being a vital link in the canal system, is one of Canada's foremost tourist attractions.

Officially listed as Lock No. 21 of the system, it is the highest hydraulic lift lock in the world.

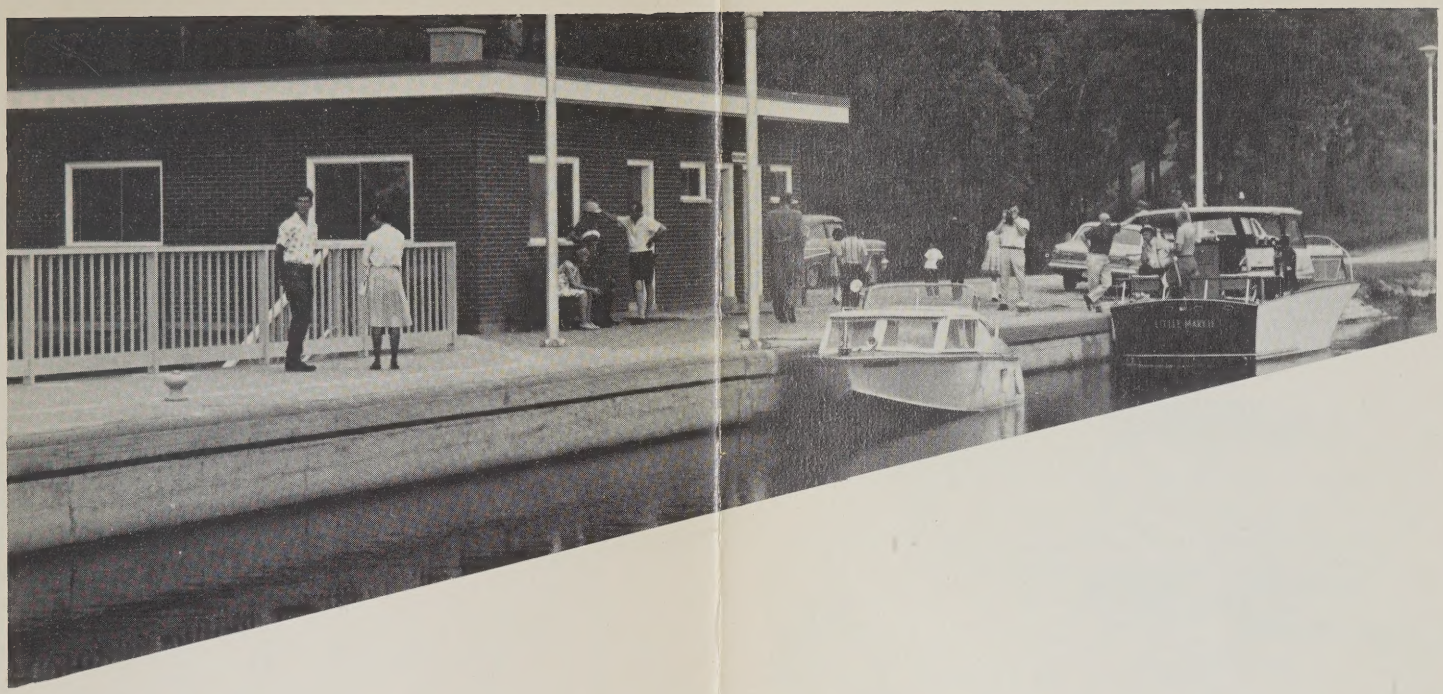
A lift lock is a self-powered machine and is used in place of conventional locks where a great difference in level occurs within a short distance. There are two such locks on the Trent Canal system, the other being at Kirkfield, Ont.

The Peterborough lock has chambers 140 feet long, with a width of 33 feet, a normal water depth of eight feet and a lift of 65 feet. The Kirkfield lock has the same general dimensions but its lift is 48 feet. The load of water and steel which comprises one lock chamber is 1,700 tons. This is the maximum load which it is necessary to provide for, since a floating vessel displaces its own weight of water.

In principle, a lift lock can be likened to two immense hydraulic elevators with the presses filled with water and connected together so that as one descends, it forces the water into the press of the other, causing it to ascend.

In place of the ordinary elevator platform, there is a large watertight box, or chamber, each end of which is closed by a gate. A lockage is performed by allowing a boat to enter the chamber, then closing the chamber gate and also closing the gate at the end of the canal channel. This leaves the Chamber independent of the canal channel, and free to move vertically.

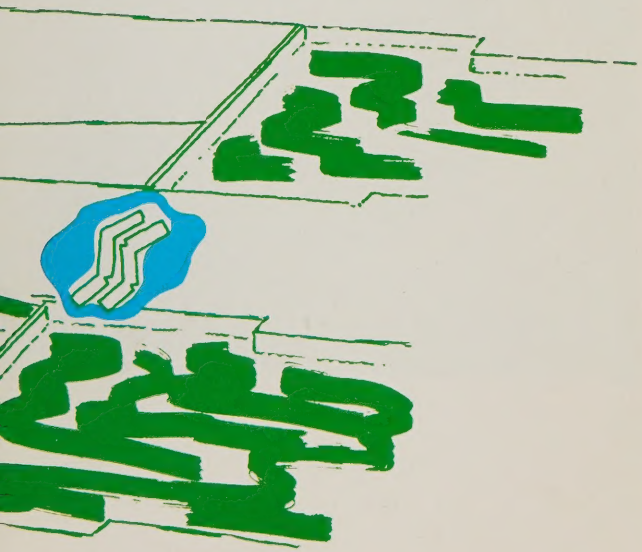
The chamber, with the boat in it, is then raised or lowered to the other level of the canal. There, by opening the gate at the other end of the chamber, and the gate at that canal end, the boat can pass out into the canal again.



(1) A cruiser, right, awaits passage from the upper level of the Otonabee River to the lower

The raising of the lower chamber is achieved by filling the upper one with a foot more of water than is in the lower, thus giving it more weight. This causes it, as it descends, to push the other chamber up when the valve connecting the two presses is opened.

The history of the lock goes back to 1896, when its construction began. It was completed in 1904 and was regarded as one of the world's most remarkable construction achievements. It was operated as originally constructed, requiring little more than nominal maintenance for the next 59 years. In 1963 the chamber steelwork was renovated, and in the following year the hydraulic, mechanical and electrical systems were given similar attention, with a fully automatic control system being installed. At the same time, a new control building was built on the centre pier of the upper reach.



– CONCRETE STRUCTURE –

The substructure of the lock is built of approximately 26,000 cubic yards of unreinforced concrete. It is divided into three main parts –

(a) the breast-wall and wings, which serve as retaining walls for the upper reach;
(b) the towers, which maintain the lock chambers in their vertical movement;
(c) the side walls and lower reach gateways, which form two dry pits into which the steel lock chambers alternately descend.

The breast wall is 40 feet thick and about 80 feet high, the length being 126 feet at the base. At a point about 15 feet above the rock foundation a pump room is built in the structure, in which the original pumps and turbines were installed. The main power units for the new hydraulic and electrical systems are now located there. At the original natural ground level, the breast wall is pierced by a road tunnel, which forms an extension of Peterborough's Hunter Street.

Part of the upper centre pier was rebuilt in 1964 to provide a room in which the upper gate operating machinery could be housed, with a new control building above. Originally, the centre tower was connected to to the centre pier by a steel walkway and the lockmaster operated the lock from the cabin on top of the centre tower. Now, however, the entire operation is handled from the new control building.

The three towers are approximately 100 feet high and are designed so as to ensure the smooth operation of the massive lock mechanism.

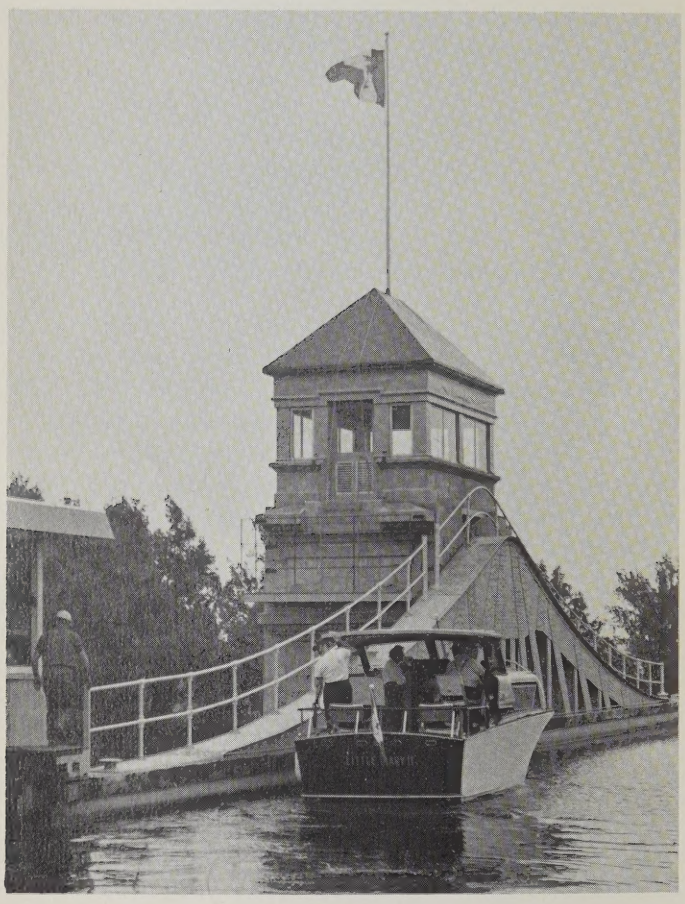
– STRUCTURAL STEELWORK –

The lock superstructure was built by Dominion Bridge Company of Montreal, being started in the summer of 1901 and completed in July 1904. The cost was $244,000.

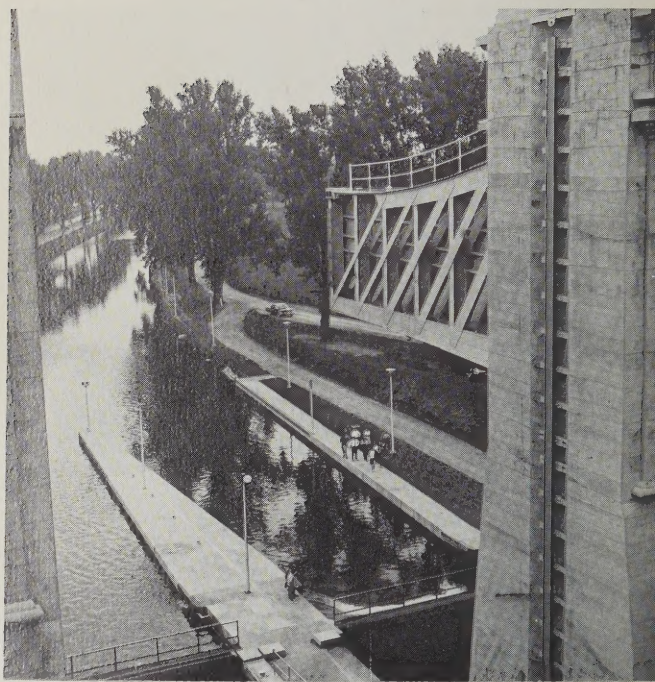
Double cantilever trusses carry the load of the chambers. The trusses have a depth at centre of 32 feet and the centre guides, operating over this length, provide the necessary stability against pitching.

All other main structural members are built-up from the simple sections available at the time of the original construction; all connections were originally rivetted.

(2) *The yachtsman moves his craft into the lock chamber.*



(3) *The lower entrance to the lock, seen from above.*



(4) The west chamber of the lock, in which the yacht is floating, is seen in its highest position; the east chamber is at the level of the lower reach of the river.

– THE GATES –

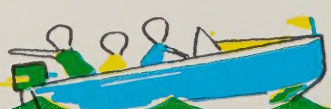
There are eight gates in all, one at each end of the two chambers and the four reach gates which operate in conjunction with the chamber gates. The original gates were built of steel and because of their tremendous weight were each provided with an air buoyancy tank to reduce the force required to open and close them.

The new gates, installed in 1964, are of aluminum, with the water-tight sealing units attached by stainless steel bolts. The gates open only in pairs; i.e. one chamber gate and its corresponding reach gate move simultaneously. A safety device in the gate mechanism makes an accidental opening of the gates in mid-air impossible.

Watertightness is ensured between the gates and their adjacent parts by rubber seals of special design that ensure against water leaking out of the closed chambers or from the reaches when their end gates are shut.

In operation of the lock, the water displaced by a descending ram is driven through a 12-inch pipe into the other press, causing it to rise. The operation is controlled by the lockmaster from the control cabin by means of an intricate valve system and he can adjust the level of a lock chamber within a tolerance of one-half inch.

The lock has an auxiliary control system for use in case of a break-down in the main machinery.



When originally built, the lock was regarded as a structure of vital importance to the movement of commerce of that day, providing a short water route from Lake Ontario to Lakes Huron, Michigan and Superior. Today, however, the Trent system is no longer a commercial route and its traffic constitutes Canada's greatest density of pleasure boating.

The rate of development of pleasure traffic through the lock in recent years is indicated by the fact that the number of lockages in 1965, 2,682, was 1,088 more than the total for 1960. The trend is continuing; in 1966, for example, there were 3,016 individual craft locked through, a total of 334 more than in 1965.

Construction of the lift lock was a project of sizeable proportions; the average depth of the excavation for the major concrete works was about 40 feet, the excavated material being used to build the embankments of the upper reach. The excavation was completed in 1899, leaving a solid rock base upon which to build.

The wells in which the presses stand were excavated in the rock to a depth of about another 75 feet, each well having a diameter of 16 feet, six inches. Granite blocks were laid in the bottom of each well to form a firm foundation for the steel presses.

The Peterborough lift lock has been one of Canada's outstanding tourist attractions since it first went into service in 1904 and visitors continue to come to the lock by the thousands every summer. With its colossal mechanism refurbished, it will continue to be one of the country's greatest "must see" items of the tourist's itinerary for decades to come, as it serves as an elevator extraordinary for the Trent system's boat traffic.

(5) The west chamber is almost half-way down, the other one moving upward.

(6) The downbound yacht can be seen as the chamber nears the end of its descent.

(7) The lockage completed, the cruiser moves out of the chamber to continue its journey.

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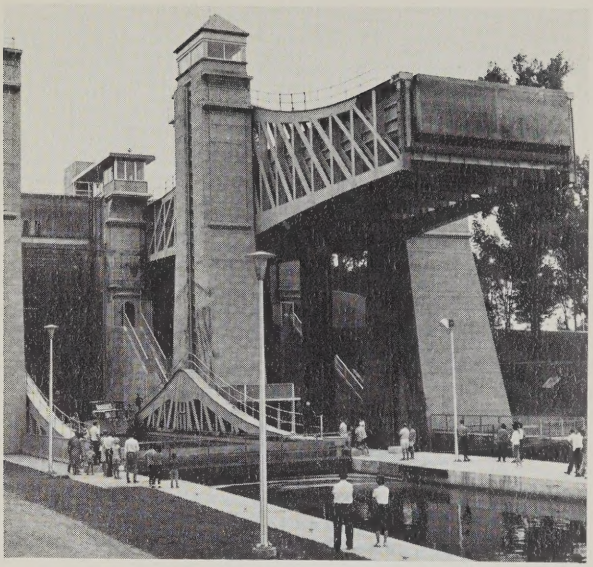

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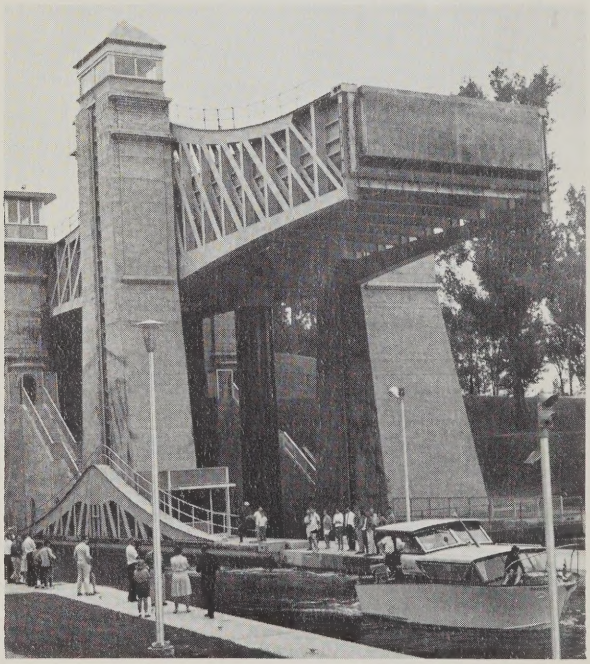


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